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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/683,858	10/10/2003	Vladislav Vashchenko	P05701	1770

7590 02/22/2005

Jurgen Vollrath
588 Sutter Street #531
San Francisco, CA 94102

EXAMINER	
LUHRS, MICHAEL K	

ART UNIT	PAPER NUMBER
2824	

DATE MAILED: 02/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/683,858	VASHCHENKO ET AL.	
	Examiner	Art Unit	
	Michael K. Luhrs	2824	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 September 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *10-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 October 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: *updated search history*.

DETAILED ACTION

Drawings

1. Acceptance of drawings filed on 10 October 2003 is withdrawn.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: '302' Please add '302' to Figure 3, to identify the mask, (in accordance with spec. line 12, p. 5).

3. The drawings are objected to because Figure 4 does not identify the substrate with a numeral, such as '300' as used in Figure 3. Since this apparently the same substrate depicted in Figure 3, please add '300' to Figure 4 and add --300-- after "substrate" in line 19, p. 5 of the specification accordingly.

4. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified

and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

5. The disclosure is objected to because of the following informalities: p. 2, line 20, change "my" to --by--.

Appropriate correction is required.

Claim Objections

6. Claims 13 and 15 are objected to because of the following informalities: Claim 13, line 3, states "forming an isolation layer between active regions and substrate of the device", however, the examiner looks to the method steps to form such isolation region, not to a description to locate the area as it may be conveniently referenced by the applicant to features in the *final* make up of the device. Applicant's Figure 4 shows the isolation layer formed *in* the substrate, but the examiner is unable to pinpoint the location intended for the isolation layer, by the phrase as 'between active regions *and substrate'*, albeit the active regions are not formed until applicant's Figure 6, this does not make clear the use of *"and substrate"*. (While, "between active regions ...of the device" may be understood as to where the isolation region resides *after* forming the active regions, "between active regions **and substrate** of the device" is apparently an attempt to describe the method that the isolation is *in* the substrate apparently claiming either, before or after, forming active regions, and sometime thereafter, an epitaxially layer is grown above, i.e. the appearance after completion. The epitaxially layer is found in applicant's dependent claim 15. Claim 15 is not definite as to whether the applicant considers the substrate to be an epitaxially grown layer or not, therefore the applicant is at least indicating that the

isolation layer is formed between active regions and somewhere in the substrate of the device whatever the substrate may be comprised of after device completion. Appropriate correction is required.

7. Claim 16 is objected to because of the following informalities: The examiner points out that the applicant's use of the term 'snapback device' in the preamble of claim 13, and then further indicating that the snapback device is an ESD device in claim 16, is not appropriate for method steps, because claim 13 has not set forth any steps to form the snap back device. Apparently claim 13, line 3, "of the device" should read as --of said snapback device--, however the examiner would still be unclear as to the relationship of the snapback device to the active regions, in claim 13, i.e. does a single snapback device have two active regions that are formed, hence 'regions' being plural as it is now, or, is the isolation region between active regions of snapback devices, (suggesting each snapback device has an active region, and isolation formed between them) hence, again, there is insufficient relationship as to where the isolation region location is to be formed because no snap-devices are formed. Please improve to cite actual method steps, not the device features, see objection above.

8. For the record, a telephonic interview was conducted with Attorney Vollrath on 12/16/04 which resulted in eliminating Cresswell USPN 4,224,083 reference, since examiner agreed Cresswell "radiates", while the present application specifically claims 'doping' or 'spotted implants'. Another telephone call was made to resolve the objection above, however Attorney Vollrath was traveling.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claims 10-12 are rejected under 35 U.S.C. 102(e) as being anticipated by Vashchenko et. al. (herein after as "Vashchenko") USPN 6,586,317.

11. The applied reference has a common assignee and inventors with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Vashchenko teaches mask '304' in Fig. 3A having opening '310' for doping of n-isolation region 320-N (shown in Fig. 3C) and during such doping, the opening '306' in mask 304 in Fig. 3A is used to dope the zener region 320-Z (shown in Fig. 3C). Hence, openings '310' and '306' are 'perforations' in mask '304', and is used to dope isolation region 320-N and the zener area, discussed above. Opening '306' may further be comprised of a perforated opening having fingers as depicted in Fig. 4B. Mask '304' is described in lines 15-22, column 4, and opening '306' is further described in lines 23-36, column 4. Therefore , Vashchenko teaches a

mask for *controlling doping levels of an isolation region by using a perforated mask during doping of the isolation region*, when one considers the perforations as the openings 306 and 310 in mask 304, albeit the effect of control of breakdown **as suggested by applicant's preamble**, such breakdown is apparently affected by the *multiple* perforations as fingers expressly **exclusive** to opening 306 in order to mask the zener region (emphasis added), hence it is considered as ***during*** the doping of the isolation because a common mask is used to form 320-N and the zener area, albeit the control of the breakdown voltage is apparently governed by the doping in the zener region. Fig. 5 graph (line 66-67, column 7) shows the control of the breakdown voltage.

Regarding claims 11-12, Vashchenko teaches annealing in line 57, column 4. And for claim 12, again, annealing takes place in lines 50-51, column 5 and lines 25-26, column 7, is considered one or more predefined elevated temperatures, albeit no specific temperature is called for, albeit an inherent temperature is required and to determine the extent of diffusion from the annealment.

A person shall be entitled to a patent unless –

12. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

13. Claims 13 and 15-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Amaratunga et. al. (herein after as "Amaratunga") USPN 6,259,134.

Regarding claim 13, Amaratunga teach, *a method for increasing the breakdown voltage of a snap back device comprising: forming an isolation layer between active regions and substrate of the device, wherein the isolation layer includes forming spotted implants*, since Amaratunga's buried layer '11' isolates the epi layer 4a from 4b (therefore the buried layer is considered to be an isolation layer) having epitaxial layer 4, during a pause between the epitaxially growth, see

lines 9- 23, column 3, to form the buried layers '11' in Fig. 1, between active layers n-epi '4b' and n-epi '4a'. The epi-layers are formed above Amarantunga's substrate 1. Amarantunga also teaches the buried isolation layer '11' in Figures 1 and 2, between thyristors '17' and PIN's '16', respectively, such regions are clearly considered *active*. The examiner points to the spacing of regions '11' (lines 28-47, column 5) i.e. that they control the breakdown since they act to protect the bottom of the trench from high field potential in lines 29-32, column 5, (i.e. the additional protection is to permit the device to sustain in higher voltage, the result is *a method for increasing the breakdown voltage*, see lines 52-63, column 4). The examiner considered the *two* buried regions '11' that are shown in Fig. 1, to be "spotted", i.e. having the *two* spotted regions shown.

Regarding claim 15, Amaratunga teaches, as discussed above, that there is a pause in the epitaxially layer 4b growth, to make time for the buried region to be formed, hence the implants are provided before *one* epitaxially layer is grown, namely epi layer 4a is grown, and the diffusion (drive) (line 13, column 3), takes place (after first growing epi-layer '4b'.

Regarding claim 16, Amaratunga teaches, that the overall configuration, i.e. having as the PIN diode with the thyristor, (lines 32-34, column 1) is considered to *at least offer* ESD protection, (see the objection above).

14. Claims 13-14, 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Webb et. al. USPN 5,516,705 (herein after as "Webb") Webb teaches, *a method for increasing the breakdown voltage of a snap back device comprising: forming an isolation layer between active regions and substrate of the device,* as midlayer 44 (line 41-42, column 9) *wherein the isolation layer includes forming spotted implants*, as spotted implants because windows of dopant are implanted

(lines 42-43, column 9) to form the buried isolation regions '42'. Therefore regarding claim 14, an isolation region is formed using a mask with intermittent openings because windows of dopant are implanted (see lines 42-43, column 9). The examiner considers the description of windows of dopant as being sufficient that Webb is suggesting the windows of dopant for forming regions '42' be as forming *spotted implants* , such regions being 'discrete' (see line 18, column 10). The placement allows for greater surge capacity and lower overshoot (lines 36-37, column 9). Regarding claim 16, Webb's device is an overvoltage protection device.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Webb et. al. as applied to claim 13 above, and further in view Jaeger, Introduction to Microelectronic Fabrication. Vol. V, Addison-Wessley, 1993, pp. 51-57, 99-103. Jaeger teaches that an implant and anneal process is preferred over diffusing using a high temperature, for the purpose of forming abrupt junctions and for the obvious purpose of annealing to repair the damage from an implant, see lines 19-20, p. 103. Since Jaeger and Webb are all interested in forming the buried region an anneal would have been recognized by Webb to repair the area damaged by the implant. Regarding claim 18, Webb lacks the predefined temperatures for predefined times, yet such is known for forming devices as taught by Jaeger such as to repair damage (discussed

above) and for drive in (see p. 57, section 4.4, for the types of temperature cycles a device may be subject to). It would have been obvious to one having ordinary skill in the art to expose the device to predefined temperatures for predefined times such as an anneal to repair damage and an anneal for drive in cycle or whatever other predefined temperature cycles that occurs from wafer to final device, as taught by Jaeger.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Beasom USPN 6,555,894 teaches a mask (Fig. 2b) identified as a 'stripe collector mask' that has perforations as illustrated in the opening 3', (lines 66-67, column 4), it is pointed out that Beasom teaches the mask for a PN junction (line 12, column 2) i.e. is a 'collector well' (line 36, column 2).

Several patents involve the use of a perforated mask for '**termination regions**' these are: Letavic et. al. USPN 6,642,558; Bakowski et. al. USPN 5,801,836 ; and Arthur et. al. USPN 4,927,772 and Traijkovic et. al. USPN 6,426,520.

Porter USPN 6,355,508 and USPN 6,787,400 teach an ESD with graded junction. Bartko et. al. USPN 4,311,534 reverses recovery charge of thyristors by nuclear irradiation. Merchant USPN 6,150,200 forms a drain with spotted plurality of implants. Several n+ regions are shown in Fig. 2 of Unterweger et. al. USPN 5,150,271. Deboy et. al. USPN shows high-voltage device with variably doped alternating regions. Norris USPN 4,827,497 teaches n+ regions '92' and '93' in Fig. 9 function to lower the breakover voltage (see lines 27-29, column 6). Pathak et. al. USPN 4,967,256 teaches forming buried region 6 by diffusion or ion beam implantation through the

upper surface of the substrate (lines 27-30, column 3). Colman is explicit in diffusion of the buried regions (3A) line 3-4, column 4 and breakover voltages have been found to be higher (lines 61-63, column 3). See also Webb et. al. 4,914,045. Plural deep buried regions made by ion implantation (lines 27-29, column 8) and by varying the impurity levels in the buried regions, breakover ranges in the range of about 60-350 volts can be achieved (lines 31-33, column 8) as taught by Casey et. al. USPN 6,407,901. Takizawa USPN 5,962,878 teaches forming buried layers 46 in surge device by implanting through a photoresist mask and diffusion drive in (lines 29-43, column 150, Fig. 14. Photoresist mask to withstand implant is seen in lines 27-30, column 3 of Bonn USPN 4,604,790 for isolation regions. It is known that isolation can be achieved by interdispersed dopant implant between adjacent wells of the same dopant. (lines 40-45, column 4) as taught by Lee USPN 5,557,131. A buried region 23 is formed through a mask into epi-layer 22 as taught by Ducreux US 2004/0012034. Turner Jr, et. al. teach a thin epi layer with appropriate doping is grown for low avalanche breakdown voltage USPN 6,781,161. DIAC and TRIAC and isolation is seen in Noguier et. al. USPN 4,755,862. An isolation region formed by implanting dopant through the isolation region and below it to form isolation between active regions is taught by Sivan, et. al. USPN 5,358,890. Susak et. al. USPN 5,604,373 teaches p+ isolation region for a transistor formed by photoresist and dopant diffusion. Spotted buried and multiple shorting dots is well known as taught by Webb et. al. USPN 5,479,031.

17. Several related patents having at least one common inventor are: Vaschenko et. al. USPN 6,660,602 for blocking mask; USPN 6,784,029 suggests shifting the mask position during doping (col. 5, line 57); as does USPN 6,717,219 (in col. 7 line 37); USPN 6,815,732 shows a silicon

controlled rectifier; USPN 6,559,507 shows doped NLDD regions 50 to reduce n+ drain ballast , i.e. claim 4.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael K. Luhrs whose telephone number is 571-272-1874. The examiner can normally be reached on M-F, 8-5.

19. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard T. Elms can be reached on 571-272-1869. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

20. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Michael K. Luhrs
2/15/05

RICHARD ELMS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800